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A NEW SPECIES OF TRICHOSTRONGYLOID NEMATODE, *ODILIA BAINAE*, FROM A NATIVE RODENT, *RATTUS FUSCIPES* (WATERHOUSE)

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Summary

BEVERIDGE, I. & DURETTE-DESSET, M.-C. (1992) A new species of trichostrongyloid nematode, *Odilia bainae*, from a native rodent, *Rattus fuscipes* (Waterhouse). *Trans. R. Soc. S. Aust.* **116**(4), 123-128, 30 November, 1992.

Odilia bainae sp. nov. is described from the duodenum of *Rattus fuscipes* (Waterhouse) from Blackwood, Victoria. The new species differs in having shorter spicules than any congener (0.26-0.28 mm), in having a symmetrical bursa and in the number of body ridges.

KEY WORDS: Nematoda, Trichostrongyloidea, *Odilia*, new species, *Rattus*.

Introduction

Very few studies have been undertaken to ascertain the parasite fauna of the various species of the genus *Rattus* endemic in Australia (Mackerras 1958). The most extensive survey to date on the parasites of *Rattus fuscipes* in Victoria (Obendorf 1979) revealed several undescribed species of nematodes including two which were described. A third species, referred to by Obendorf (1979) as "*Longistriata* sp. (undescribed)" was found at a single locality (Blackwood) in Victoria. In this paper, we describe and name the new species as a precursor to studies on its ultrastructure and life history.

Materials and Methods

Nematodes collected from the duodenum of naturally infected *Rattus fuscipes* from Blackwood, Victoria (37°29′S, 144°19′E) were washed in 0.9% saline and fixed live in either hot 70% ethanol or 2.5% glutaraldehyde in phosphate buffer at 4°C. Additional specimens were obtained from laboratory-reared *Rattus fuscipes* infected either orally or subcutaneously with the third-stage larva of the nematode and from laboratory rats *(Rattus norvegicus)* infected via the same routes. Specimens fixed in ethanol were cleared in lactophenol and examined using Nomarski interference microscopy. Drawings and measurements were made using a drawing tube attached to an Olympus BH microscope. Transverse sections of the body of male and female nematodes were prepared using a cataract scalpel and were mounted in lactophenol for examination. An apical view of the cephalic extremity was prepared by the same means. Morphological terms for the body ridges and bursal rays follow Durette-Desset (1985). Ridges dorsal to the axis of orientation of the synlophe were numbered from left to right, 1, 2, 3 . . . etc, while ridges ventral to the axis were numbered from left to right 1^1, 2^1, 3^1 . . . etc. Measurements were made on five male and five female specimens and are presented, in millimetres, as the range followed by the mean in parentheses. Specimens fixed in glutaraldehyde were embedded in resin, sectioned at a thickness of 1 μm, stained with toluidine blue and examined under the light microscope.

Type specimens and specimens from experimental infections have been deposited in the collections of the South Australian Museum (SAM), Adelaide.

Odilia bainae sp. nov.
FIGS 1-18

Longistriata sp. (undescribed) of Obendorf (1979).

Types: Holotype male, from duodenum of *Rattus fuscipes* (Waterhouse), Blackwood, Victoria, 15.x.1991, SAM V4181; allotype female, SAM HC22890; paratypes, 12 ♂♂, 10 ♀♀, SAM HC22879, 22883.

Material examined: From *R. fuscipes* (natural infection): types; (experimental infections): 26 ♂♂, 29 ♀♀ (SAM HC22881). From *R. norvegicus* (experimental infections): 14 ♂♂, 17 ♀♀, (SAM HC22875).

Description: Small, sinistrally-coiled nematodes, red in colour when live; prominent cephalic vesicle present, symmetrical in shape; buccal capsule vestigial, teeth absent; mouth opening sub-triangular, surrounded by six tiny labial papillae; four double sub-median papillae and paired amphids present, external to labial papillae; dorsal oesophageal gland small but distinct in apical views of head; oesophagus claviform; nerve ring in mid-oesophageal region; deirids dome-shaped,

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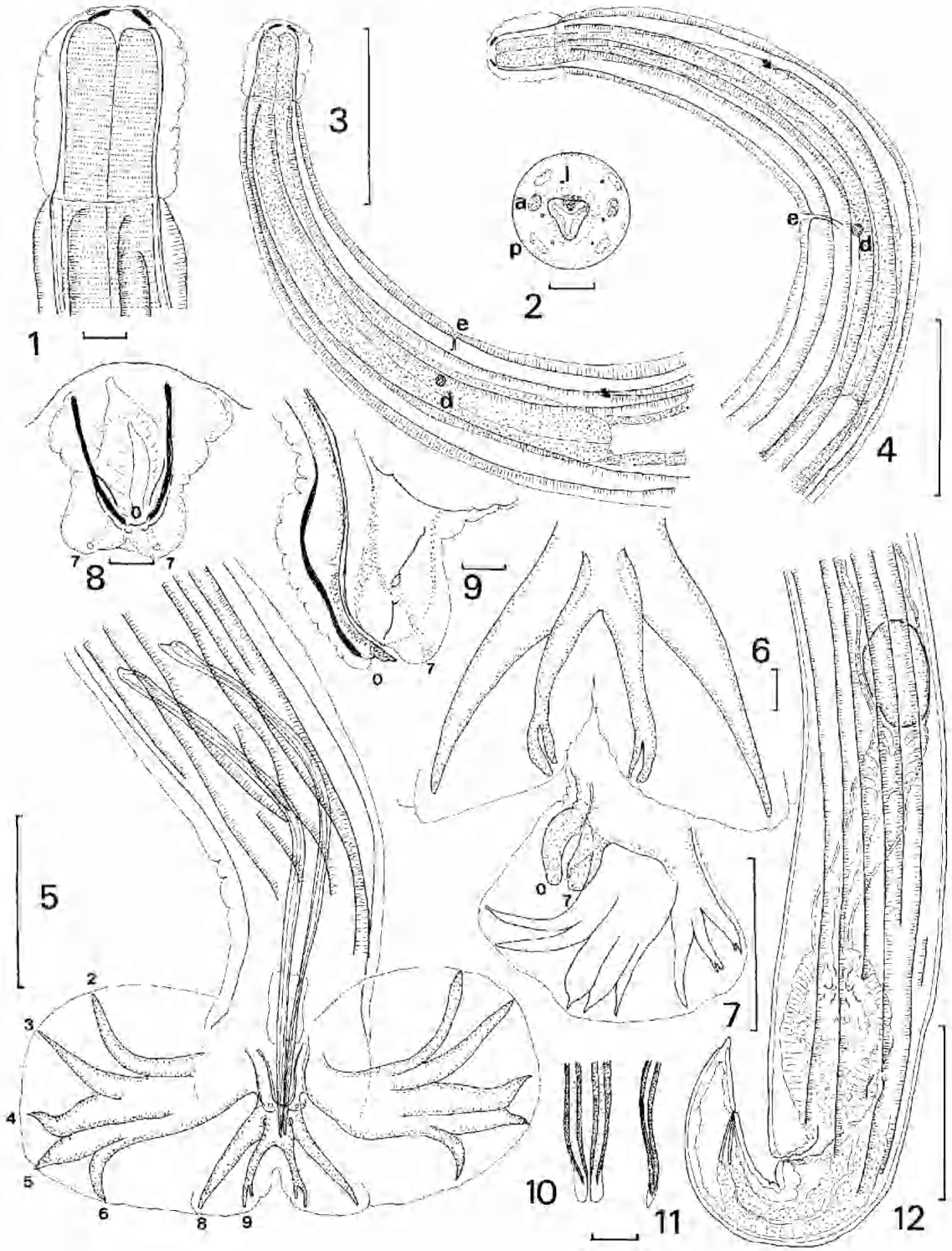
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in region of excretory pore. Synlophe composed of 17 longitudinal ridges in mid-body region; axis of orientation (Fig. 13) from right-ventral field to left-dorsal field at approximately 40° to horizontal; diminutive carene, or cuticular dilation, present on left dorsal aspect between ridges 2' and 5 (Figs 14, 17); nine ridges in dorsal field, ridges 1 to 5 small, ridges 6 and 7 larger, ridges 8 and 9 small; eight ridges in ventral field, ridges 4 and 5 larger than either 1 to 3 or 6 to 8; some variation in relative size of ridges occurs along body of nematode, with ridges 1(1') and 2(2') diminishing in size in mid-body region (for example, compare Figs 13 and 14); most ridges arise immediately posterior to cephalic vesicle, single ridge on left side arises at level of nerve ring; single ridge on right side arises posterior to excretory pore; number and orientation of ridges variable in posterior extremity of body.

Male. Length 3.5-4.1 (3.8), maximum width 0.09-0.10 (0.09); cephalic vesicle 0.04-0.05 (0.05) long; oesophagus 0.31-0.36 (0.34) long; nerve ring 0.16 from anterior extremity; excretory pore 0.23-0.24 (0.23) from anterior extremity; deirids 0.23-0.25 (0.24) from anterior extremity; spicules 0.26-0.28 (0.27) long; gubernaculum lightly sclerotised, visible only in few specimens, 0.05-0.07 (0.06) long. Synlophe: ridges branch and anastomose irregularly in posterior region of body; up to 19 ridges at level of spicules; ridges reduced but relatively uniform in size, most oriented perpendicular to body, synlophe orientation difficult to discern. Bursa symmetrical, dorsal lobe reduced. Dorsal ray symmetrical, divided near origin, terminal subdivisions short, symmetrical; rays 8 arising with dorsal trunk, papillae 8 close to margin of bursa; rays 4, 5, 6 grouped together; ray 6 slender, sharply recurved near extremity; ray 5 robust; ray 4 robust, almost acuminate; rays 2 and 3 slender, reaching margin of bursa. Genital cone extremely prominent, lightly sclerotised; ventral lip conical with single apical papilla, dorsal lobe with paired papillae 7. Spicules elongate, alate, triquetrous in transverse section; similar; tips with slightly expanded flange of clear spicular material in dorso-ventral view; gubernaculum present, very lightly sclerotised, not visible in all specimens.

Female. Length 4.3-4.9 (4.6), maximum width 0.10-0.13 (0.11); cephalic vesicle 0.04-0.06 (0.05) long; oesophagus 0.33-0.44 (0.38); nerve ring 0.19 from anterior extremity; excretory pore 0.23-0.27 (0.25) from anterior extremity; deirids 0.25-0.27 (0.26) from anterior extremity; tail 0.03-0.07 (0.05); vulva to posterior end 0.09-0.17 (0.12), egg 0.07-0.08 (0.08) by 0.04-0.05 (0.05). Monodelphic; infundibulum short; egg thin-shelled, ellipsoidal. Synlophe: Ridges interrupted in posterior part of body, disappear at level of vulva; up to 19 ridges present at level of infundibulum, ridges reduced in size and uniform in size, most oriented perpendicular to body; orientation of synlophe difficult to discern. Tail short, conical; vulva close to anus.

Discussion

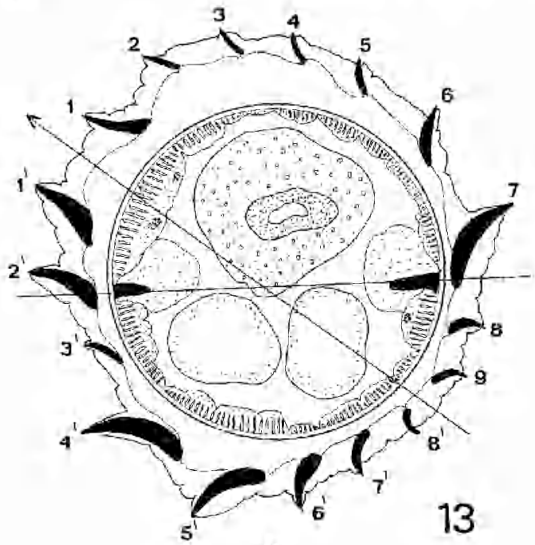
The species described above clearly belongs to the Nippostrongylinae Durette-Desset, 1971 in possessing a synlophe oriented between 45 and 67° from the sagittal axis and a latero-median gradient in ridge size. In possessing a carene, or swelling on the left dorsal aspect of the body, with a moderately hypertrophied left lateral ridge and an obvious size difference between the left lateral ridge and the left dorsal ridges, the nematode belongs to one of series of related genera, *Neoheligmonella* Durette-Desset, 1971, *Carolinensis* Travassos, 1937, *Odilia* Durette-Desset, 1973 and *Nippostrongylus* Lane, 1923 (see Durette-Desset 1983). The possession of a dorsal ray divided close to its origin and a common origin for the dorsal and externo-dorsal rays exclude this species from *Neoheligmonella* and *Carolinensis*, while the symmetry of its bursa, and in particular rays 6, exclude it from *Nippostrongylus*. Genera erected since the publication of the key of Durette-Desset (1983), *Malaistrongylus* Ow Yang, Durette-Desset & Ohbayashi, 1983, *Rattustrongylus* Ow Yang, Durette-Desset & Ohbayashi, 1983, and *Sabanema* Ow Yang, Durette-Desset & Ohbayashi, 1983, all differ from the species described above in lacking a hypertrophied left lateral ridge (see Ow Yang *et al.* 1983). The species described above therefore belongs to *Odilia*.

Figs 1-12. *Odilia hainae* sp. nov. from *Rattus fuscipes*. 1, cephalic extremity, showing cephalic vesicle; 2, apical view of anterior extremity; 3, anterior end, right side, showing origin of ridge (arrow) at level of oesophago-intestinal junction; 4, anterior end, left side, showing origin of ridge (arrow) at mid-oesophageal level; 5, posterior end of male, ventral view, showing irregularities in ridges; 6, dorsal lobe of bursa, dorsal view; 7, lateral view of bursa showing prominent genital cone; 8, genital cone, ventral view; 9, genital cone, lateral view; 10, spicule tips, ventral view; 11, spicule tip, lateral view; 12, tail of female.

Figs 5-9 follow ray numbering system as described by Durette-Desset (1985); 0,7 represent the papillae of the genital cone in the same system.

Legend: a, amphid; d, deirid; e, excretory pore; l, labial papilla; m, submedian papilla.

Scale lines: figs 1, 2, 6, 8-11, 0.01 mm; figs 3-5, 7, 12, 0.1 mm.



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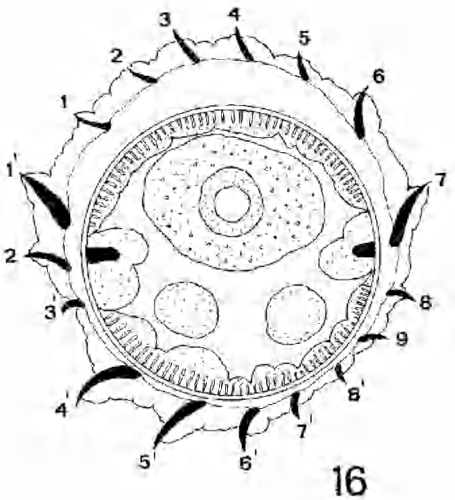

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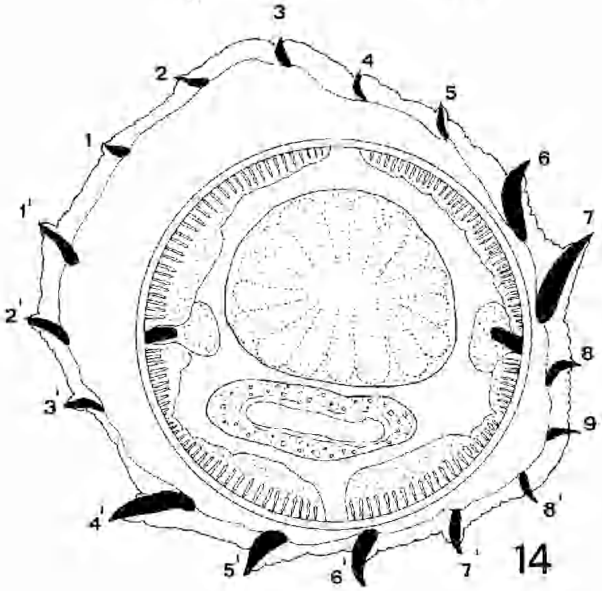

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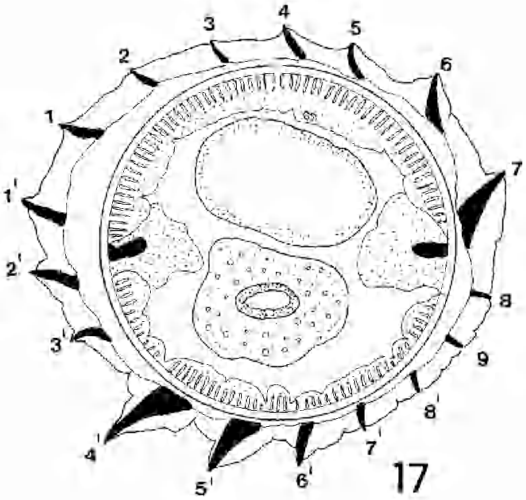

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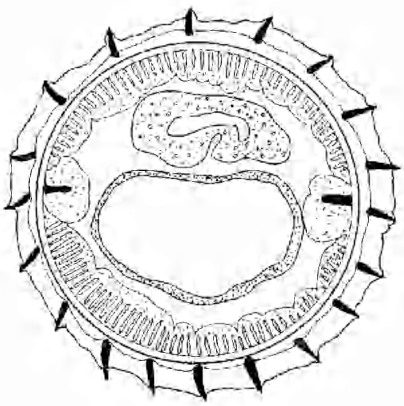

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The genus *Odilia* was established to contain seven species of trichostrongyloid nematodes belonging to the Nippostrongylinae, parasitic in Australian murid rodents. The genus is clearly related to *Nippostrongylus*, which is cosmopolitan in rodents, particularly *Rattus* spp. (see Durette-Desset 1970), *Neoheligmonella* in African murid rodents and *Carolinensis* in holarctic arvicolid and gerbillid rodents, but is distinguished primarily by the characteristic form of the dorsal ray (Durette-Desset 1971) which is deeply divided and arises at the origin of the externodorsal rays. The new species described here was initially identified as "*Longistriata* sp., undescribed" (*sensu* Mawson 1961) by Obendorf (1979). The species described above can be differentiated from all congeners by its extremely short spicules (0.26-0.28 mm). It differs from *O. mackerrasae*, *O. mawsonae*, *O. brachybursa*, *O. polyrhabdote* and *O. emanuelae* in possessing a symmetrical caudal bursa. The remaining species, *O. melomys* and *O. uromys* have a symmetrical bursa. The new species also differs from all congeners in which the synlophe has been described in the number of ridges in the mid-body region, 17 in the new species compared with 14 in *O. brachybursa*, 18 in *O. emanuelae*, 16 in *O. mackerrasae*, 15 in *O. melomys*, 36 in *O. polyrhabdote* and 21 in *O. mawsonae*, although *O. mawsonae* has 17 ridges in the anterior part of the body (Durette-Desset 1969). The number of ridges in *O. uromys* is not known. Thus the material described confirms the observation of Obendorf (1979) that it is a new species, which we here name *O. bainae*, after Dr Odile Bain, in whose honour the genus was erected.

The presence of an additional species of *Odilia* in an endemic species of *Rattus* is of interest in view of current hypotheses on the evolutionary relationships of the genus. Mawson (1961) observed that the trichostrongyloid genera present in endemic murine rodents, that is the species of *Rattus*, belong primarily to *Nippostrongylus* and *Austroheligmonema* Mawson, 1961, although *Austroheligmonema* is now regarded as a synonym of *Nippostrongylus* (see Durette-Desset 1971). Those nematodes present in the "Old endemic" rodents belonging to the sub-family Hydromyinae were mainly species placed in the genera *Longistriata* Schulz, 1926 and *Heligmonoides* Baylis, 1928, although all of them are now included in a single genus *Odilia*. In a re-examination of the morphology of Australian species by Durette-Desset (1969), a trend in synlophe morphology was observed from species with a carene, hypertrophied left, lateral ridges and a size gradient in ridges from right to left towards synlophes such as that found in *O. polyrhabdote* in which the number of ridges was increased, but their sizes diminished and the distinctive orientation was lost. Because the former type of synlophe occurs in genera such as *Nippostrongylus* which occur in south-east Asia, Durette-Desset (1971, 1985) considered these findings consistent with the hypothesis that the hydromyine rodents reached Australia with nematodes resembling *Nippostrongylus*, and that the genus *Odilia* evolved in isolation in the Hydromyinae. The more recent arrival of species of *Rattus* in Australia about one million years ago (Watts & Aslin 1981) probably introduced or re-introduced *Nippostrongylus*, and lead to the development of the two endemic species, *N. typicus* and *N. magnus* in *Rattus fuscipes*. According to this hypothesis, species of *Odilia* present in endemic Australian *Rattus* spp represent transfers from hydromyine rodents.

With respect to synlophe morphology, the new species fits within the transition series envisaged by Durette-Desset (1969). The number of synlophe ridges (17) is greater than that expected in the supposed ancestral state (14) and although a size gradient in the ridges remains, the carene is not prominent. Two species of *Odilia* occur in *Rattus* species in addition to *O. bainae*, these being *O. emanuelae* in *R. conatus* and *O. polyrhabdote* in *R. fuscipes* (syn *R. assimilis*). In each instance, the species of *Rattus* involved is broadly sympatric with hydromyine rodents, principally *Melomys* spp. (Watts & Aslin 1981) which could have acted as donors in the transfer to *Rattus* spp. At Blackwood, the only known locality for *O. bainae*, no other hydromyine rodents other than the water rat, *Hydromys chrysogaster*, occur. This suggests that *O. bainae* is exclusively a parasite of *Rattus* spp., and that transfer of the species of *R. fuscipes* occurred some time in the past, either when hydromyine rodents occurred in the area, or prior to the extension of *R. fuscipes* into this region. However, of the Australian hydromyine rodents, only the parasites of *Hydromys*, *Uromys* and *Melomys* have thus far been studied, and for many species and genera, there are as yet no records (see Mackerras 1958). Therefore any conclusions on the host or geographic distributions of individual nematode species within them need to be treated with some caution.

Figs 13-18. *Odilia bainae* sp.nov. from *Rattus fuscipes*. Transverse sections at different levels showing synlophe. 13, male, 0.40 mm from anterior end with arrow indicating axis of orientation of synlophe; 14, male, mid-body region, 2.2 mm from anterior end; 15, male, section at level of spicules, 0.26 mm from posterior end; 16, female, 0.40 mm from anterior end; 17, female, mid-body region, 1.4 mm from anterior end; 18, female, 0.20 from posterior end. Scale line, 0.01 mm.

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